WHAT IS CLAIMED IS:

1. A spin valve thin film magnetic element comprising:

a pair of nonmagnetic conductive layers, a pair of pinned magnetic layers, and a pair of antiferromagnetic layers for respectively pinning the magnetization directions of the pair of pinned magnetic layers, which are laminated in turn on both sides of a free magnetic layer in the thickness direction to form a laminate on a substrate;

a pair of bias layers located on both sides of the laminate in the track width direction, for orienting the magnetization direction of the free magnetic layer in the direction crossing the magnetization direction of each of the pinned magnetic layers; and

a pair of lead layers laminated on the bias layers, for supplying a sensing current to the laminate;

wherein of the pair of antiferromagnetic layers, at least the antiferromagnetic layer apart from the substrate is made narrower than the free magnetic layer in the track width direction to form lead connecting portions of the laminate on both sides of the narrow antiferromagnetic layer in the track width direction; and

the pair of lead layers are extended from both sides of the laminate in the track width direction to the center of the laminate and connected to the laminate through the pair of lead connecting portions.

2. A spin valve thin film magnetic element according to Claim 1, wherein in addition to the narrow antiferromagnetic layer, at least a portion or the whole of the pinned magnetic layer adjacent to the antiferromagnetic layer is made narrower than the free magnetic layer to form lead connecting portions of the laminate on both sides of the narrow antiferromagnetic layer and pinned magnetic layer, and the pair of lead layers are extended from both sides of the laminate in the track width direction to the center thereof and connected to the laminate through the pair of lead connecting portions.

3. A spin valve thin film magnetic element according to Claim 1, wherein in addition to the narrow antiferromagnetic layer, the pinned magnetic layer adjacent to the narrow antiferromagnetic layer and a portion the nonmagnetic conductive layer adjacent to the pinned magnetic layer are made narrower than the free magnetic layer to form lead connecting portions of the laminate on both sides of the narrow antiferromagnetic layer, pinned magnetic layer and nonmagnetic conductive layer, and the pair of lead layers are extended from both sides of the laminate in the track width direction to the center thereof and connected to the laminate through the pair of lead connecting portions.

4. A spin valve thin film magnetic element according to Claim 1, wherein the pair of the connecting portions

respectively comprise notch portions formed on the side apart from the substrate to be located at both ends of the laminate in the track width direction, and the width of each of the lead connecting portions in the track width direction is in the range of 0.03 to 0.5 μm.

5. A spin valve thin film magnetic element according to Claim 1, wherein the pair of bias layers are adjacent to the free magnetic layer to be located at the same layer position as at least the free magnetic layer, and the upper surfaces of the pair of bias layers are joined to the laminate at positions nearer to the substrate than the lead connecting portions so that only the pair of lead layers are connected to the pair of lead connecting portions.

6. A spin valve thin film magnetic element according to Claim 1, wherein each of the pair of the pinned magnetic layers comprises a laminate of at least two ferromagnetic layers and a nonmagnetic intermediate layer inserted between these ferromagnetic layers, and the magnetization directions of the adjacent ferromagnetic layers are antiparallel to each other to bring the whole pinned magnetic layer into a ferrimagnetic state.

7. A spin valve thin film magnetic element according to Claim 6, wherein each of the pair of the pinned magnetic layers comprises a laminate of two ferromagnetic layers and

a nonmagnetic intermediate layer inserted between these ferromagnetic layers, and the magnetization directions of the adjacent ferromagnetic layers are antiparallel to each other to bring the whole pinned magnetic layer into a ferrimagnetic state.

8. A spin valve thin film magnetic element according to Claim 1, wherein of the pair of antiferromagnetic layers, the antiferromagnetic layer located near to the substrate is formed to extend beyond the free magnetic layer in the track width direction so that the bias layers are laminated on the extensions of the antiferromagnetic layer.

9. A spin valve thin film magnetic element according to Claim 1, wherein the bias layers are laminated, through bias underlying layers made of Ta or Cr, on the extensions of the antiferromagnetic layer located near to the substrate.

10. A spin valve thin film magnetic element according to Claim 1, wherein intermediate layers made of Ta or Cr are respectively laminated between the bias layers and the lead layers.

11. A spin valve thin film magnetic element according to Claim 1, wherein each of the pair of antiferromagnetic layers comprises any one of XMn alloys and PtX'Mn alloys (wherein X represents one element selected from Pt, Pd, Ir,

Rh, Ru, and Os, and X' represents at least one element selected from Pd, Cr, Ru, Ni, Ir, Rh, Os, Au, Ag, Ne, Ar, Xe and Kr).

12. A spin valve thin film magnetic element according to Claim 1, wherein the laminate comprises a central sensitive zone which has high reproduction sensitivity and can substantially exhibit a magnetoresistive effect, and dead zones which are formed on both sides of the sensitive zone in the track width direction and have low reproduction sensitivity, and which cannot substantially exhibit the magnetoresistive effect; and

wherein the pair of lead connecting portions formed at both ends of the laminate are formed on the dead zones of the laminate, and the pair of lead layers are formed to extend from both sides of the laminate in the track width direction to the dead zones and to adhere to the laminate.

13. A method of manufacturing a spin valve thin film magnetic element comprising:

the laminated film forming step of laminating in turn an antiferromagnetic layer, a pinned magnetic layer, a nonmagnetic conductive layer, a free magnetic layer, another nonmagnetic conductive layer, another pinned magnetic layer and another antiferromagnetic layer on a substrate to form a laminated film;

the resist forming step of forming a lift off resist on

the laminated film, the resist comprising a butting surface in contact with the laminated film and both side surfaces holding the contact surface therebetween, and a pair of notches provided on both sides of the butting surface in the track width direction to be located between the butting surface and both side surfaces;

the laminate forming step of entirely or partially etching the laminated film outside both side surfaces of the lift off resist in the track width direction by irradiating the laminated film with an etching particle beam in the direction at an angle θ_1 with the substrate to form a laminate having a substantially trapezoidal sectional shape;

the bias layer forming step of depositing other sputtered particles on both sides of the laminate in the direction at an angle θ_2 (however, $\theta_2 > \theta_1$) of with the substrate to laminate a pair of bias layers to the same layer position as at least the free magnetic layer;

the lead connecting portion forming step of etching at lest the portions of the other antiferromagnetic layer corresponding to the pair of notches by irradiating the laminate with another etching particle beam in the direction at an angle θ_3 (however, $\theta_1 > \theta_3$) with the substrate to form a pair of lead connecting portions; and

the lead layer forming step of depositing still other sputtered particles on the laminate and the bias layers in the direction at an angle θ_3 with the substrate to form a pair of lead layers which extend from both sides of the

laminate in the track width direction to the center thereof to be connected to the laminate through the pair of lead connecting portions.

14. A method of manufacturing a spin valve thin film magnetic element according to Claim 13, wherein in the lead connecting portion forming step, in addition to the portions of the other antiferromagnetic layer corresponding to the notches, the other pinned magnetic layer is partially or entirely etched corresponding to the notches to form a pair of lead connecting portions.

15. A method of manufacturing a spin valve thin film magnetic element according to Claim 13, wherein in the lead connecting portion forming step, the other antiferromagnetic layer and the other pinned magnetic layer are etched corresponding to the pair of notches, and the other nonmagnetic conductive layer is partially etched corresponding to the pair of notches to form a pair of lead connecting portions.

16. A method of manufacturing a spin valve thin film magnetic element according to Claim 13, wherein in the laminate forming step, the laminated film is etched outside both side surfaces of the lift off resist in the track width direction to leave a portion of the antiferromagnetic layer adjacent to the substrate.

17. A method of manufacturing a spin valve thin film magnetic element according to Claim 13, wherein the bias layer forming step comprises forming the bias layers and depositing sputtered particles at the angle θ_1 to form intermediate layers made of Ta or Cr on the bias layers, and the lead connecting portion forming step comprises forming the lead connecting portions and, at the same time, etching a portion of the intermediate layers.

18. A method of manufacturing a spin valve thin film magnetic element according to Claim 13, wherein the angle θ_1 is in the range of 60 to 85°, the angle θ_2 is in the range of 70 to 90°, and the angle θ_3 is in the range of 40 to 70°.

19. A method of manufacturing a spin valve thin film magnetic element according to Claim 13, wherein the widths of the pair of lead connecting portions in the track width direction are respectively defined by the widths of the notches of the lift off resist in the track width direction.

20. A method of manufacturing a spin valve thin film magnetic element comprising:

the laminated film forming step of laminating in turn an antiferromagnetic layer, a pinned magnetic layer, a nonmagnetic conductive layer, a free magnetic layer, another nonmagnetic conductive layer, another pinned magnetic layer

and another antiferromagnetic layer on a substrate to form a laminated film;

the first resist forming step of forming a first lift off resist on the laminated film, the first resist comprising a butting surface in contact with the laminated film and both side surfaces holding the contact surface therebetween, and a pair of notches provided on both sides of the butting surface in the track width direction to be located between the butting surface and both side surfaces;

the laminate forming step of entirely or partially etching the laminated film outside both side surfaces of the first lift off resist in the track width direction by irradiating the laminated film with an etching particle beam in the direction at an angle θ_4 with the substrate to form a laminate having a substantially trapezoidal sectional shape;

the bias layer forming step of depositing other sputtered particles on both sides of the laminate in the direction at an angle θ_5 (however, $\theta_5 > \theta_4$) with the substrate to laminate a pair of bias layers to the same layer position as at least the free magnetic layer;

the second lift off resist forming step of removing the first lift off resist and forming a second lift off resist at substantially the center of the top of the laminate, the second resist comprising a butting surface narrower than the butting surface of the first lift off resist and both side surfaces holding the narrow butting surface therebetween, and a pair of notches provided on both sides of the narrow

butting surface in the track width direction to be located between the butting surface and both side surfaces;

the lead connecting portion forming step of etching at least the portions of the other antiferromagnetic layer outside both side surfaces of the second lift off resist in the track width direction by irradiating the laminate with another etching particle beam in the direction at an angle θ_6 with the substrate to form a pair of lead connecting portions; and

the lead layer forming step of depositing still other sputtered particles on the laminate and the bias layers in the direction at an angle θ_6 with the substrate to form a pair of lead layers which extend from both sides of the laminate in the track width direction to the center thereof to be connected to the laminate through the pair of lead connecting portions.

21. A method of manufacturing a spin valve thin film magnetic element according to Claim 20, wherein in the lead connecting portion forming step, the other antiferromagnetic layer is etched outside both side surfaces of the second lift off resist in the track width direction, and the other pinned magnetic layer is partially or entirely etched outside both side surfaces of the second lift off resist in the track width direction to form a pair of lead connecting portions.

22. A method of manufacturing a spin valve thin film magnetic element according to Claim 20, wherein in the lead connecting portion forming step, the other antiferromagnetic layer and the other pinned magnetic layer are etched outside both side surfaces of the second lift off resist in the track width direction, and the other nonmagnetic conductive layer is partially etched outside both side surfaces of the second lift off resist in the track width direction to form a pair of lead connecting portions.

23. A method of manufacturing a spin valve thin film magnetic element according to Claim 20, wherein in the laminate forming step, the laminated film is etched outside both side surfaces of the first lift off resist in the track width direction to leave a portion of the antiferromagnetic layer adjacent to the substrate.

24. A method of manufacturing a spin valve thin film magnetic element according to Claim 20, wherein the bias layer forming step comprises forming the bias layers and depositing sputtered particles at the angle θ_4 to laminate intermediate layers made of Ta or Cr on the bias layers, and the lead connecting portion forming step comprises partially etching the intermediate layers at the same time as formation of the lead connecting portions.

25. A method of manufacturing a spin valve thin film

magnetic element according to Claim 20, wherein the angle θ_4 is in the range of 50 to 85°, the angle θ_5 is in the range of 60 to 90°, and the angle θ_6 is in the range of 50 to 90°.

26. A method of manufacturing a spin valve thin film magnetic element according to Claim 20, wherein the widths of the pair of lead connecting portions in the track width direction are respectively defined by the relative distances between side positions of the laminate and the side positions of the second lift off resist.

27. A method of manufacturing a spin valve thin film magnetic element according to Claim 13, wherein in the lead connecting portion forming step, the sputtered particle type discharged from the laminate during etching is analyzed by secondary ion mass spectroscopic analysis to detect the end point of etching.

28. A method of manufacturing a spin valve thin film magnetic element according to Claim 20, wherein in the lead connecting portion forming step, the sputtered particle types discharged from the laminate during etching is analyzed by secondary ion mass spectroscopic analysis to detect the end point of etching.